1859MNRAS..19..289S

veniently be reduced to $d'' = \frac{\sin 1''}{2} \cdot p''^2 \cdot \cot b$: for $p^2 = \mu m^2$ we have $(\mathrm{M}m - \mathrm{M}\mu)\,(\mathrm{M}m + \mathrm{M}\mu)$, whereof the first term is given in finding the principal correction, and the second term by adding together the parts already found, $\log \frac{\sin 1''}{2} = 4{\cdot}38454$ or simply $4{\cdot}385$; so that log cot $\mathrm{I}\mu$ is the only trigonometrical term requiring to be found. It may be remarked that $\mathrm{I}s$ being always a small arc, its cotangent will differ little from its cosecant or the arithmetical complement of log sin $\mathrm{I}s$.

For the moon's correction logs to 5 places should be used, and for the star correction 3 or 4 places may be used according as the star may be high or low.

All these corrections are easily found true to a hundredth of a second. If extreme precision were required, a small correction $= -\frac{\mathrm{M}m^3}{3\,\mathrm{R}^2} \cos \mathrm{M} \sin^2 \mathrm{M}$ should be applied on account of the difference between arc and tangent in the triangle $\mathrm{M}m\mu$.

The true expression $\tan \mathrm{M}\mu = \tan \mathrm{M}m \cos \mathrm{M}$ reduced to arc gives $\mathrm{M}\mu + \frac{\mathrm{M}\mu^3}{3\,\mathrm{R}^2} = \mathrm{M}m^3 \cos \mathrm{M} + \frac{\mathrm{M}m^3}{3\,\mathrm{R}^2} \cos \mathrm{M} \;\therefore\; \mathrm{M}\mu = \mathrm{M}m \cos \mathrm{M} + \frac{\mathrm{M}m^3}{3\,\mathrm{R}^2} \cos \mathrm{M} - \frac{\mathrm{M}\mu^3}{3\,\mathrm{R}^2}$; the principal term being subtractive, the spherical correction becomes $-\frac{\mathrm{M}m^3}{3\,\mathrm{R}^2} \cos \mathrm{M} + \frac{\mathrm{M}m^3}{3\,\mathrm{R}^2} \cos^3 \mathrm{M} = -\frac{\mathrm{M}m^3}{3\,\mathrm{R}^2} \cos \mathrm{M} \sin^2 \mathrm{M}$.

The greatest possible value of this correction can never exceed eleven hundredths of a second.

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## *Note on the recent Occultation of Saturn by the Moon, and on Experiments for ascertaining the Polarisation of the Moon's Light.* By Professor Secchi.

(*Extract of a Letter to Admiral Manners, dated Rome, May* 9, 1859).

"We observed the occultation of *Saturn* on Sunday last with a very fine evening and steady image. We used for the purpose two different telescopes, the large refractor, power 600, and a smaller 3½-inch Fraunhofer, but we could not observe any distortion at all attributable to a lunar atmosphere. At the immersion the dark limb of the moon was very visible and distinct, so that any variation in the form of the limb of the planet would be very sensible. I noticed only the irregular outline of the limb of the moon, the planet happening to disappear between two mountains. In consequence of this circumstance the last segment of the ring, as observed at the immersion, acquired the form of an oblong bead. At the reappearance the planet was so faint in comparison with the luminous edge of the moon that it could scarcely be perceived until it had already emerged a little. It looked like *Saturn*

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1859MNRAS..19R.290T

seen by daytime half-an-hour before sunset. In this case also no sensible distortion was witnessed, although the terrestrial atmosphere was not so still as at the immersion.

"I have made some researches on the polarisation of the light reflected by the moon, and have been surprised to see the enormous difference between the mountains and the seas. It is very curious to see, for instance, the *Mare Crisium*, and other craters still smaller, polarised completely in the inner part, and only in a small degree in the outlines and ridges of the mountains. The maximum polarisation of the moon is at the seventh day of her age. The full moon is not at all polarised, *Jupiter*, *Saturn*, and *Mars*, are not more polarised than our clouds; in other words, the polarisation is insensible."

## *On the Deduction of the Latitude from Transits over the Prime Vertical.* By Captain Tennant, B.E.

Let $\varphi_{(1)}$ denote the co-latitude cleared of the effects of instrumental error, $\varphi'_{(1)}$ the uncorrected value of the co-latitude, $\delta_{(1)}$ the polar distance of the star observed, $\theta$ its hour-angle at observation. Also let $\varkappa''$ be the collimation-error, or the amount by which the small circle described by the mean of the wires differs from the great circle perpendicular to the axis of motion, $\varkappa$ being positive when the small circle is north of the other. Let $\eta$ be the angle between the north point and the place where the instrument free from collimation would cut the horizon, and $\eta''_{(1)}$ its complement in seconds, which is the error in azimuth, and is negative when the direction of the axis of motion lies between the true meridian and the star's azimuth at transit, or when $\eta$ is greater than 90°. Also let $\mu''$ be the level-error, positive when the south end of the axis is too high, and negative if the north end be highest. The author then investigates the different corrections, and finally obtains the following expression:—

$$\varphi_{(1)} = \varphi'_{(1)} + \mu'' + \varkappa'' \cos \varphi'_{(1)} \sec \delta_{(1)} + \eta''_{(1)} \sin \varphi'_{(1)} \tan \theta.$$

In a subsequent communication the author has given formulæ for reducing the transits to the mean of the wires. Both papers will be printed *in extenso* in the volume of *Memoirs*.

## *On a Method of Determining the Latitude by Transits.*
By Captain J. F. Tennant, B.E.

In this paper the author has investigated the formulæ for the effects of instrumental error in the case wherein the stars observed are not situate in the prime vertical. His object is, by means of the expressions thus obtained, to determine the

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